

1. Give the names of following elements:
 - a. the element in period 3 and group 4
Silicon
 - b. the element in period 5 and group 6
Tellurium
 - c. element in the same group as sulfur but in period 6
Polonium
 - d. a halogen in period 5
Iodine
 - e. an element in the same period as potassium that has five outer shell electrons
Arsenic
2. State whether the following properties increase or decrease across a period:
 - a. Electronegativity
Increase
 - b. atomic radius
Decrease
3. Arrange the following in order of increasing radius (smallest first)
 - a. Ba, Mg, Sr, Ca
Mg < Ca < Sr < Ba
 - b. O^{2-} , Na^+ , F^-
Na+ < F- < O2-
 - c. Na, Na^+ , K, Al^{3+}
Al3+ < Na+ < Na < K
 - d. S, Cl, I, Cl^- , S^{2-}
Cl < S < Cl- < S2- < I-
4. Are the following true or false?
 - a. A germanium atom is smaller than a silicon atom but silicon has higher first ionization energy.
False, its larger and has a lower IE
 - b. Selenium has a higher first ionization energy and electronegativity than sulfur.
False, Se as a lower first IE and electronegativity
 - c. Antimony has a higher first ionization energy and electronegativity than tin.
True
 - d. Cl^- is bigger than Cl, but Se^{2-} is smaller than Se.
False they are both bigger
 - e. Iodine has a higher electronegativity than tellurium but a lower electronegativity than bromine.
True

5. Write balanced equations for the following reactions:
- rubidium with water
$$\text{Rb} + \text{H}_2\text{O} \rightarrow \text{RbOH} + \text{H}_2$$
 - potassium with bromine
$$2\text{K} + \text{Br}_2 \rightarrow 2\text{KBr}$$
 - chlorine solution with potassium bromide solution
$$\text{Cl}_2 + 2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{Cl}^-$$
 - sodium oxide with water
$$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$$
 - sulfur trioxide with water
$$\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$$
6. State the type of structure and bonding in each of the following:
- SO_2 – molecular - covalent
 - SiO_2 – molecular – giant covalent
 - Na_2O - ionic
 - Al_2O_3 - ionic
7. Arrange the following in order of increasing melting point (lowest first):
- Cl_2 , Na, F_2 , K
$$\text{F}_2 < \text{Cl}_2 < \text{K} < \text{Na}$$
 - Si, Mg, Cl_2 , Ar, Ne
$$\text{Ne} < \text{Ar} < \text{Cl}_2 < \text{Mg} < \text{Si}$$
 - Na_2O , P_4O_{10} , O_2
$$\text{O}_2 < \text{P}_4\text{O}_{10} < \text{Na}_2\text{O}$$
8. State whether an acidic or alkaline solution will be formed when each of the following is dissolved in/reacted with water:
- SO_3
acidic
 - MgO
alkaline
 - Na
alkaline
9. Which of the following properties decrease in value down group 7?
- Electronegativity and first ionization energy
 - melting point and electronegativity
 - melting point and atomic radius
 - ionic radius and first ionization energy

10. Which of the following is a transition element?
a. Te b. Sb c. Ba **d. V**
11. Which of the following forms an alkaline solution when added water?
a. SO_3 **b. Na_2O**
c. P_4O_{10} d. SiO_2
12. Which of the following is true for two elements in the same group in the periodic table?
a. they have the same physical properties
b. they have similar chemical properties
c. they have the same electronegativity
d. they have the same number of shells of electrons
13. A non-metallic element, X, forms a gaseous oxide with the formula X_2O that reacts with water to form an acidic solution. The element X is most likely to be:
a. Na b. S **c. Cl** d. P

14.

Element	Atomic radius/ pm	Ionic radius/ pm
Na	186	98
Al	143	45
Cl	99	181
K	231	133

- a. The Atomic and ionic radii of some elements are given in the table:
- Explain why the atomic radius of aluminum is smaller than that of sodium.
Al and Na are in the same period on the PT, so they have the same shells, however Al has a greater Z_{eff} therefore the electrons are attracted more to the nucleus
 - Explain why the ionic radius of aluminum is smaller than its atomic radius but the atomic radius of chlorine is larger than its atomic radius
 Al^{3+} has fewer shells due to the loss of the 3 electrons than Al therefore it is smaller. Cl from a 1^- ion by gaining electrons. The both have the same number of protons but Cl^{1-} has one extra electron so there is greater e-/e- repulsion for the same nuclear charge
 - Explain why the ionic radius of potassium is smaller than that of chlorine.
Both have the same number of electrons (isoelectronic) but potassium has a higher nuclear charge than Cl^{1-} thus the outer electrons are pulled closer to the nucleus
- b. Explain the following in terms of structure and bonding:
- Sodium has a higher melting point than potassium
Sodium ion is smaller than potassium ion so therefore the nucleus is closer to the delocalized electrons. There is a greater attraction between the sodium ion and the delocalized electrons causing more energy to be needed to melt it

- ii. Silicon has a higher melting point than chlorine
Silicon has giant covalent structure where chlorine has a molecular covalent structure. When silicon is melted the covalent bonds must be broken requiring lots of energy however when chlorine is melted the force of attraction between the chlorine molecules must be overcome not the bond which requires less energy
- c. State the formula of tetraphosphate decoxide and write an equation for its reaction with water.
$$\text{P}_4\text{O}_{10} + 6\text{H}_2\text{O} \rightarrow 4\text{H}_3\text{PO}_4$$